

bright parts having the aspect of short lines, not occupying the whole width of the spectrum. This was perhaps merely a result of fatigue of the eyes; these phenomena were only produced during the first two nights.

"It appeared to me important to follow the modifications the spectrum might undergo as the comet went away from the sun. These modifications were produced with perfect distinctness. In the spectrum of the nucleus the violet radiations were extinguished first. About June 30 the most refrangible part, commencing with the green band ($\lambda = 516$), had sensibly lost its brightness and became invisible in the region G, while the yellow and red appeared to me as bright as on the first day. The bands, masked at first by the brightness of the continuous spectrum, became each day more visible in the neighbourhood of the nucleus, and during the night of July 1 they were perfectly distinguished on the nucleus itself.

"The measurements successively made of the bands of the comet and of those of the alcohol flame led me to conclude the identity of the two spectra. The green band however, the most brilliant, seemed a little more refracted in the comet than in the flame. To submit this matter to a decisive test, a total reflection-prism was adjusted on the slit so as to cover half of it. On placing the two spectra together I observed that they were strikingly similar when they had the same brightness, but that the green band appeared indeed more refracted in the comet when the spectrum of the flame was more brilliant. The comparison made directly between the two spectra, and the perfect coincidence of the bands, dispense with the necessity of giving numbers furnished by my micrometric measurements. They would not add anything to the certainty of the result.

"As to the violet band, it has not been possible for me to see it in a certain manner, even using a very small dispersion and a very small ocular enlargement. There is not in this fact anything surprising, if we take account of atmospheric absorption and of variations of brightness undergone by the violet band, when the experimental conditions are varied. We know that in the ordinary flame of alcohol it is very brilliant; but if this flame be cooled by means of several folds of metallic sheeting, it becomes very weak and tends to disappear, while the other bands sensibly retain their habitual aspect.

"Continuing my observations till the present, I have found the continuous spectrum of the nucleus diminish progressively in brightness and extent, especially on the violet side. At present it has the aspect of a thin luminous thread, hardly passing beyond the line F. The bands, on the other hand, seem to have retained their intensity in the head of the comet. In the tail, and to a distance from the nucleus equal to twice or thrice the diameter of the head, they are still seen, but very faintly. Further on one sees only a continuous spectrum due perhaps to the light of the moon diffused by the haze, pretty thick during the last nights of observation.

"It seems to result from this that the cometary mass is formed in part of an incandescent gas, characterised by the spectrum of bands, and in part of solid or liquid matter, likewise incandescent, but in a state of extreme division, emitting a white light which belongs to it, and capable of reflecting in a certain proportion the light it receives from the sun. All the spectroscopic observations hitherto made on comets indicate the existence of carbon in the gases producing the band-spectrum. Dr. Huggins has given this conclusion a striking demonstration by showing, with photography, the existence of two bands of carbon in the ultra-violet spectrum of the comet.

"I have the honour to submit to the Academy three drawings representing (1) the spectrum of the alcohol flame, (2) the spectrum of the comet during the night of June 24, and (3) the same spectrum on July 1."

WIDTH OF MR. RUTHERFURD'S RULINGS

BY the direction of C. P. Patterson, the Superintendent of the U.S. Coast and Geodetic Survey, I have long been engaged in the precise measurement of a wave-length of light, in order to obtain a check upon the secular molecular changes of metallic bars used as standards of length. In advance of the publication of this work it may be useful to say I have found that the closest-ruled diffraction-plates by Mr. Lewis Rutherford have a mean width of ruling which varies in different specimens from 68078 to 68082 lines to the decimetre, at 70° F. There is a solar spectral line, well suited for precise observation, whose minimum deviation with one of Mr. Rutherford's plates in the spectrum of the second order with the closest ruled plates is 45° 01' 56" at 70° F. I would propose that this line be adopted as a standard of reference by such observers of wave-lengths as desire to escape the arduous operation of measuring the mean width of their rulings; for by means of the measures which are shortly to be published it will be possible to deduce from the minimum deviation of this line produced by any given gitter, the mean width of that gitter, and consequently the wave-length of any other line whose deviation has been observed with it. The accuracy of this method will greatly exceed that of assuming Ångström's measures to be correct. The wave-length of the line in question (still subject to some corrections which may be considerable) is 5624825. Ångström gives 562336.

C. S. PEIRCE

CITY AND GUILDS OF LONDON INSTITUTE

IT would seem as if at last, after long years of waiting, there were some hope that the views which for the last quarter of a century have been so persistently advocated touching technical education, were about to bring forth more fruit in London.

In season and out of season, since the note was first sounded by the late Prince Consort, one far-seeing advocate after another, and among these we must specially name Mr. Samuelson, Mr. Mundella, and Sir Henry Cole, have cried in the wilderness touching the need of more scientific instruction. At last it does seem as if there is an awakening, as if a part of the idea was realised in the Institute, the foundation-stone of which was laid at South Kensington on Monday by the Prince of Wales. No doubt in the building which has been begun a national school of science, theoretical and applied, worthy of a country like ours, may grow up. Mr. Mundella will rejoice that at last he has an opportunity of carrying out with something like adequacy the views on education of which he has been so long a strenuous advocate. We hope next week to give a detailed description and illustration of the new building; and meanwhile will content ourselves with briefly referring to what took place on Monday.

The company present to receive the Prince of Wales was large and distinguished, including many eminent men of science. The Lord Chancellor, as Chairman of the Institute, addressed the Prince, expressing the gratification of the Council that His Royal Highness had consented to become president. The Lord Chancellor then traced the growth of the Institute and the efforts of the City Guilds to improve the technical education of the country.

"Since July of last year," the Lord Chancellor said, "the date of the incorporation of the Institute, its work has satisfactorily increased, and the Council have a lively and grateful recollection of the assistance and encouragement afforded to them by His Royal Highness, Prince Leopold, Duke of Albany, who in May last laid the foundation-stone of the Finsbury Technical College, a college that has been established by this Institute, and

which, when erected, will be the first building in the metropolis exclusively devoted to technical teaching. Pending the completion of the Finsbury College, instruction is being given to a large and increasing number of artisan students in some of the applications of chemical science to manufactures and industrial operations, and also in that new and widely opening field of labour and invention—the application of electrical science to the transmission and conservation of energy. Instruction will also be provided in that college, when finished, for those who are engaged in various handicraft trades, and it is hoped that this kind of teaching, which is gradually taking the place of apprenticeship in France, Germany, and Sweden, will help in this country to supplement, without supplanting, workshop training. The Institute is also endeavouring to advance technical education in a large number of towns in the United Kingdom by holding annual examinations in technology, and by encouraging, in connection with these examinations, the formation of evening classes for artisans, by assisting in the payment of teachers of technical subjects. During the early part of the present year more than eighty such classes were in operation, and it is satisfactory to know that the number of candidates recently examined by the Institute in different branches of technology was 1563 as compared with 816 in the previous year. But it is to the Central Institution," the Lord Chancellor went on to say, "the first supporting pillar of which your Royal Highness has graciously consented to set this day, that the Council look to crown their endeavours and give unanimity to all their efforts. In this college, from which the entire work of the Institute will be directed, instruction of a higher and more advanced character will be given, adapted to the wants of those who will be engaged in professional or commercial pursuits, in which a knowledge of some branch of mechanics, physics, or chemistry in its practical application will be found not only serviceable but almost indispensable. The building when completed will be supplied with laboratories, in which the most delicate operations can be carried on, with workshops in which the various branches of mechanical and electrical engineering will be taught, with studios in which applied art may be practised, and with a lecture-hall, theatres, and class-rooms in which the principles of science will be explained. Here, it is anticipated, will receive their professional training the sons of manufacturers, many of whom have hitherto been compelled to pursue their studies abroad—in Germany, in Switzerland, in France, or in America, in all which countries, for some time past, technical colleges, such as this Central Institution is intended to be, have already flourished. Here it is expected that artisans who have shown merit and have won distinction at the branch or provincial colleges will complete the training which may qualify them to act as managers and superintendents of works. Some of these, it is hoped, will obtain their education in this college by means of scholarships to be established by the Institute itself, possibly by provincial colleges, trade societies, or other public bodies, or by private individuals who may be interested in the promotion of technical education. And here it is anticipated will be trained that body of technical teachers, of whom there is in England at the present moment so great a need, who will carry with them from this college into the manufacturing centres, to be there imparted to other students, a knowledge of the theory and the practice of various crafts and industries. This institution will not be established as a rival to any other existing seat of learning; least of all to the excellent schools situated in this neighbourhood, which for some years past have been the means of offering to hundreds of young men and women a knowledge of the principles of science and art. The aim of this institution will be to supplement the teaching of those schools by giving instruction in the

practical application of science and art to the trades and industries of the country, and by cultivating and endeavouring to stimulate inventive genius. It is therefore hoped and anticipated that the sister institutions, representing pure and applied science, will work in harmony with each other, forming an alliance, the effect of which will be to raise the intellectual *status* and to improve the technical knowledge and practical skill of the working classes of this country, and so to increase its industrial prosperity. It gives me great pleasure to be enabled to add that it has seemed fit to Her Majesty to recognise on this occasion the eminent services of Mr. Bramwell, the indefatigable chairman of the executive committee of the institution, by signifying Her Majesty's gracious intention of conferring upon that gentleman the honour of knighthood. It is anticipated that the cost of this building, when fully equipped with the apparatus and appliances needful for technical instruction, will not fall far short of 75,000*l.* Of this sum 31,000*l.* has been already subscribed by the worshipful companies of Fishmongers, Goldsmiths, Clothworkers, and Cordwainers; the grant of the Drapers' Company having been appropriated to the Finsbury College; and it is expected that about 24,000*l.* will be saved from the annual income of the Institute during the building of this college. The Council therefore, after paying the amount which is due, will have at their disposal only an estimated sum of about 55,000*l.*, and they look to the liberality of the Livery Companies, both of those who have and of those who have not as yet subscribed to the funds of the Institute, to make good the balance of 20,000*l.*, so that the building of this college may be completed at once and as a whole, in strict accordance with the plans."

The Prince of Wales in reply made some forcible and sensible remarks on the necessity to this country of improved technical education—education in things as contrasted with words—if we are to keep our place among the other industrial nations. "Other nations," the Prince said, "which did not possess in such abundance as Great Britain coal, the source of power, and iron, the essence of strength, compensated for the want of raw material by the technical education of their industrial classes, and this country has therefore seen manufactures springing up everywhere guided by the trained intelligence thus created. Both in Europe and in America technical colleges for teaching, not the practice, but the principles of science and art involved in particular industries, had been organised in all the leading centres of industry. England is now thoroughly aware of the necessity for supplementing her educational institutions by colleges of a like nature." The new building, the Prince remarked, will be of considerable benefit to the whole kingdom, not only as an example of the Institute devoting itself to technical training, but as a focus likewise for uniting the different technical schools in the metropolis already in existence, and as a central establishment also to which promising students from the provinces may, by the aid of scholarships, be brought to benefit by the superior instruction which London can command. The Prince reminded his audience that the realisation of the idea of such a college was one of the most cherished objects which his father had in view. "It is to me," the Prince stated, "a peculiar pleasure that the Commissioners of the Exhibition, of which I am the president, have been able to contribute to your present important undertaking, by giving to you the ground upon which the present college is to be erected with a sufficient reserve of land to insure its future development. By consenting at your request to become the president of this institute I hope it may be in my power to benefit the good work, and that our joint exertions, aided, I trust, by the continued liberality of the City and Guilds of London, may prove to be an example to the rest of the country to train the intelligence of industrial communities, so that, with the increasing competition of the world, England may

retain her proud pre-eminence as a manufacturing nation." Among the articles deposited in the stone were copies of the *Times*, *Nature*, and the *City Press*.]

NOTES

THE Graham medal, instituted in connection with the Philosophical Society of Glasgow (Chemical Section), for the encouragement of chemical research, and open to competition to all chemists, has, on the recommendation of Prof. Williamson, F.R.S., the adjudicator in the competition, been awarded to Mr. James Mactear, F.C.S., F.I.C., for a paper entitled "Some Researches on the Reactions involved in the Leblanc Process of Alkali Manufacture."

THE fifty-fourth meeting of the German Association of Naturalists and Physicians will be held at Salzburg on September 18-24 next. From the list of addresses we note the following:—Dr. von Pettenkofer (Munich), on the soil and its connection with the health of man; Herr Meynert (Vienna), on the laws which govern human thoughts and actions; Dr. von Oppolzer (Vienna), on the question: Is Newton's law of gravitation sufficient for the explanation of the motion of heavenly bodies, and are there reasons to designate it only as approximately true? Herr Mach (Prague), on natural history teaching. All these addresses (besides one by Herr Weismann (Freiburg-im-Breisgau), the subject of which is not yet fixed) will be delivered at the general meetings. For the entertainment of visitors sufficient preparations will be made; the programme enumerates social gatherings, concerts, and excursions into the charming neighbourhood of Salzburg.

THE German Society for Anthropology, Ethnology, and Prehistoric Research will meet this year at Ratisbon on August 8-10 next. The programme of the meeting is a very varied one. In the first place the members will visit the curiosities and collections of the ancient city itself and the numerous Roman antiquities in the neighbourhood. At the Roman necropolis near Kumpfmühl some excavations will be made. Addresses will be delivered on the Roman period in Germany, on the period of serial tombs, on the pre-Roman metal age, on the stone period, and on anthropological questions generally.

ON Saturday the Prince of Wales opened, at South Kensington, the International Medical and Sanitary Exhibition which is being held in connection with the forthcoming Medical Congress. Up to the present nearly 2000 members of the medical profession have signified their intention of attending the Congress.

AT the Annual General Meeting of the Society of Arts medals were awarded as follows for papers read at the meetings of the Society:—Prof. A. Graham Bell, E. P. Edwards (of the Trinity House), Mr. Alex. Siemens, Sir Bartle Frere, Mr. J. Y. Buchanan, Prof. Perry, Sir Richard Temple, and Mr. J. M. Maclean.

AMONG recent valuable additions of models of ships to the collection now being exhibited in the galleries south of the Royal Horticultural Gardens is a whole model of the *Livadia*, showing in miniature all the details of that noted yacht. It is lent by the builders, Messrs. John Elder and Co. The London and Glasgow Shipbuilding and Engineering Company have lent half-block models of three of their steamships, and by an ingenious use of mirrors in mounting these the whole of each vessel is represented, and fore and aft views can be conveniently studied. There are many other admirable models.

THE geological distribution of endemic goitre in England has been made the subject of a recent paper by Prof. Lebour of Newcastle. He shows that there is on the whole a striking

sameness in the distribution in this country and in France, where Dr. de St. Lager of Lyons has fully investigated the facts. One important point only he considers to be established as common to those rocks on which goitre does not occur—the absence of limestone together with that of metallic impurities. In both countries the rocks which support most goitre are such as are both calcareous and metalliferous. But there are plenty of facts to show that metalliferous impurities alone cannot be credited with the origin of the disease, else the Devonian and the granite would surely not be free from it. Neither will the absence of limestone alone be sufficient to check the growth of the disease, else the lignitiferous beds of France and the ferruginous sands of the Weald would not support it. (Dr. de St. Lager's conclusion is that endemic goitre coincides with metalliferous deposits, iron pyrites being in the first rank.)

THE Handbook of the Vertebrate Fauna of the County of York, by W. E. Clarke and W. D. Roebuck, the secretaries of the Yorkshire Naturalists' Union, is expected to appear about the beginning of August. The work will show what species are, or have been, within historical periods, found in Yorkshire. The authors are enabled to enumerate, as such, 508 species out of a total British list of 756, a fauna superior in numerical extent to that of any other county in the British Isles. The list includes 46 mammals, more than 300 birds (doubtful species being excluded), 12 reptiles and amphibians, and upwards of 150 fishes. For comparison, the British species *not* found in Yorkshire are also enumerated. Application should be made to the above-named gentlemen, 9, Commercial Buildings, Park Row, Leeds.

THE Marine excursion of the Birmingham Natural History and Microscopical Society to Oban this year, which extended from July 1 to July 12, proved a great success, and fully answered the expectations of its promoters. Thirty-two Members joined the excursion, including Dr. Thomas Wright, F.R.S., the President of the Midland Union of Natural History Societies, and Mr. E. D. Hamel, Ex-President of the Tamworth Natural History Society. There were also several ladies. A little steamer—the *Curlew*—of about twenty-five tons burthen, was chartered for a week. Dredging operations were carried on daily in the Bay of Oban and the neighbourhood in depths varying from fifteen to fifty fathoms, under the superintendence of Mr. Edmund Tonks, B.C.S., and Mr. W. R. Hughes, F.L.S. A most interesting and beautiful collection of animals was taken. The specimens included fine examples of the Alcyonarian zoophytes. The Echinoderms embraced many genera from *Antedon* (*Comatula*) through the group to *Holothuria*. The Molluscs were not very numerous, but they included several rare forms. A few interesting fishes were taken, including the Lump-Sucker. The specimens will be examined by specialists and reported to the Society in due course. Those Members who did not engage in the dredgings had good opportunities of botanising and geologising, the indefatigable honorary secretary, Mr. Morley, having arranged a series of excursions to the principal places of interest in the district. On Sunday evenings July 3 and July 10, Dr. Wright also gave by request addresses "On the Basaltic Formations of Staffa and Iona," and "On Glaciation," which afforded great gratification to the Members. In the evenings demonstrations were given by the microscope and otherwise on the more interesting forms of life taken, by Prof. Bridge, Mr. W. P. Marshall, Mr. W. R. Hughes, and Mr. G. W. Tait. By the courtesy of Mr. R. H. Scott, of the Meteorological Office, telegrams were received daily, giving the weather forecasts for the morrow, which enabled the members to make their arrangements. At the termination of the excursion votes of thanks were accorded to the leaders of the party, who rendered assistance in various ways, and a resolution was passed selecting the Channel Islands as the place for the next marine excursion.